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MODULAR PROTECTED ENTRANCE TERMINAL

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An entrance terminal and interface between the telephone company network and the subscriber's premises is more readily serviced by a single module having an enclosed printed circuit board combining the voltage overload device, the demarcation plug and socket and a service circuit such as a half-ringer or maintenance termination unit.

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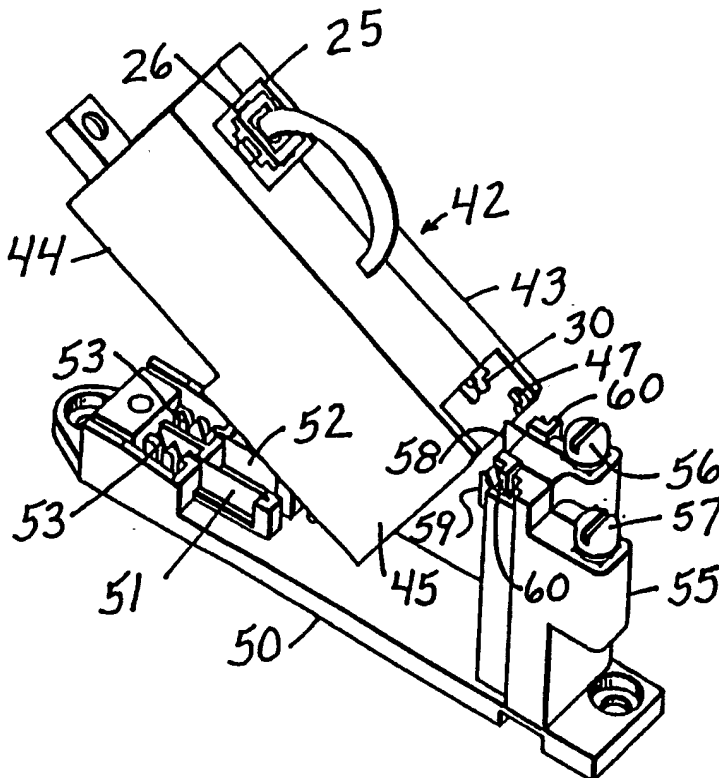


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(21) International Application Number: PCT/US91/05058 (22) International Filing Date: 17 July 1991 (17.07.91) (30) Priority data: 575,076 30 August 1990 (30.08.90) US (71) Applicant: MINNESOTA MINING AND MANUFACTURING COMPANY [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US). (72) Inventors: HENDERSON, Daniel, H. ; HOFFMAN, Charles, W. ; SCHERER, Richard, J. ; Post Office Box 33427, Saint Paul, MN 55133-3427 (US).	(74) Agents: BARNES, John, C. et al.; Post Office Box 33427, Saint Paul, MN 55133-3427 (US). (81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent). Published <i>With international search report.</i> <i>With amended claims.</i>	

(54) Title: MODULAR PROTECTED ENTRANCE TERMINAL**(57) Abstract**

An entrance terminal and interface between the telephone company network and the subscriber's premises is more readily serviced by a single module having an enclosed printed circuit board combining the voltage overload device, the demarcation plug and socket and a service circuit such as a half-ringer or maintenance termination unit.



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MODULAR PROTECTED ENTRANCE TERMINALBackground of the Invention5 1. Field of the Invention

The present invention generally relates to terminals for use in the telecommunications industry for separating the wires of the telephone company network from the inside wiring of the subscriber, and more particularly to a module for an entrance terminal which incorporates, adjacent to the demarcation point, overvoltage protection, a jack, and a half-ringer or a maintenance termination unit.

10 2. Description of the Prior Art

15 It has become a requirement that there be a demarcation between the telephone lines of the telephone company and terminal protective equipment and the subscribers lines at the premises for data communication equipment and/or telephones. The demarcation point is preferably outside the premises to allow access at any time by the telephone company and is to be where the wiring crosses a property line or the closest point to where the wiring enters a multi-unit building or buildings. The demarcation point for single unit installations is positioned within twelve inches of the protector or, where there is no protector, within twelve inches of where the telephone wire enters the customer's premises.

25 The prior art teaches the use of modules for the connection of incoming telephone lines and the customers lines. These prior art modules comprise a module for connection to the incoming telephone lines and a modular plug and jack for plugging in of the customers lines. The module not only includes the plug-in arrangement but can incorporate the line protectors, and other circuits for performing service functions. Two patents disclosing such prior art devices are U.S.A. Patents Nos. 4,613,732 and 4,742,541.

30 Patent No. 4,588,238 discloses a simplistic

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telephone network interface where the incoming lines and the customers lines are joined at the interface by an RJ11C modular plug and jack. A similar interface is illustrated in patent No. Des. 291,081. The use of such or similar modular devices is illustrated in U.S.A. patents 4,723,919; 4,749,359; and 4,800,588.

Other protected entrance terminals have used interface connectors as described to be positioned between a panel adapted to support a plurality of surge arrestors and individual ringers or maintenance termination units in series with the interface connectors. These terminals used protective devices as described in patent No. 4,583,954 which plugged into the panels.

In all these devices the physical size of the terminals were larger and they were more costly than desired by the service companies to protect the customer lines and to afford electronic checks to be made on the network lines in the event of a report of some malfunction.

The present invention affords an alternative to having to acquire entrance panels with expandable properties and then as necessary add the protection equipment to plug into the panel and the suitable circuitry to improve the servicing of the lines.

Summary of the Invention

The present invention provides a novel module for an entrance terminal which is adapted to use one or a series of modules to connect an incoming cable to the lines of one or more subscribers.

The terminal includes a module for use at the interface between telephone company communications facilities incoming lines and the wiring at a subscriber's premises. The module comprises a printed

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circuit board having a first pair of contacts for receiving the incoming tip and ring lines, a third contact for connection to ground, and an outgoing pair of contacts, the fourth and fifth, for connection to the wiring at a subscriber's premises. A surge arrestor for overvoltage protection is mounted on the printed circuit board and is joined to the first pair of contacts which are also connected through the board to an engagable socket or jack for a modular plug. The plug is connected to the board by a flexible cord and at least two mounting pads, and circuit means afford connection between the mounting pads and an outgoing pair of contacts.

The circuit means of the module may include a half-ringer circuit. The first pair of contacts and the outgoing pair of contacts comprise tuning fork contacts for making sliding contact with blade contacts joined to the incoming lines and the wiring at the subscriber's premises for affording facile attachment and detachment of the module from the lines and wiring. The module may further comprise a pair of shells which enclose the printed circuit board, allow access to the socket and permit the contacts to extend therefrom for affording wiping connection of the contacts to fixed contacts of an otherwise open circuit between the telephone company lines and the premise wiring.

A protected entrance terminal according to the present invention comprises support means for mounting at least a pair of mating contacts, adapted for connection to two incoming lines, and for supporting a ground bar. A post is positioned perpendicular to the support, which post supports a pair of mating contacts having means for connection to a pair of customers wires. The post has hinge means affording one portion of a pivot axis. A module comprising a generally rectangular box, having opposite faces joined by side walls, encloses a printed

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circuit device having a surge protector device and a plurality of wiping contacts extending from two adjacent side walls of the box for mating with the earlier mentioned contacts. The box further has means for cooperating with the hinge means for affording pivotal movement of the box in relationship to the post to make successive connection between the mating contacts on the post and the wiping contacts extending from one side wall of the module and then to make successive contact between a wiping contact on an adjacent side wall and the ground bar, and a further electrical contact between the other wiping contacts, extending from the adjacent side wall, and the mating contacts supported on the support means when the module is pivoted about the post hinge means.

A protected entrance terminal for receiving the incoming lines from a telephone company's facility and connecting the same to the wiring from a subscriber's premises according to the present invention comprises a housing unit having a base and a cover, inlet openings in the base for insertion of cables and wires into the base, means in the base for defining a splicing area, support means positioned in the base for mounting at least a pair of like contacts adapted for connection to two incoming lines from a cable and for supporting a ground bar, post means positioned upright in the base for supporting at least a pair of mating contacts having connectors for connection to a pair of wires, and hinge means on the post means defining one portion of a pivot axis about which a modular interface device may be pivoted to connect the otherwise open circuit between the company cable and the subscriber wires as described above.

Description of the Drawing

The present invention will be further described hereinafter with reference to the accompanying drawing

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wherein:

Figure 1 is an isometric view of the circuit board of the module of the present invention;

Figure 2 is a plan view of the front of the circuit board;

Figure 3 is a plan view of the back side of the circuit board;

Figure 4 is top view of the module of the present invention;

Figure 5 is a side elevational view of the module;

Figure 6 is a bottom view of the module;

Figure 7 is a side elevational view of the module connected to the mating contacts of a terminal;

Figure 8 is a side elevational view of the module being pivoted in relationship to the terminal;

Figure 9 is an isometric exploded view showing the module being removed or placed on the terminal;

Figure 10 is an isometric view of a protected entrance terminal according to the present invention; and

Figure 11 is a front elevational view of the base of a protected entrance terminal showing a plurality of modules therein.

Description of the Presently Preferred Embodiments

The module and protected entrance terminal of the present invention will now be described in greater detail with reference to the accompanying drawing wherein like reference numerals refer to like parts throughout the several views.

The module of the present invention is for use at the interface between telephone company communications facilities incoming cable to an entrance terminal and the wiring at a subscriber's premises. Referring now to Figure 1, the module comprises a printed circuit board,

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generally designated 15, supporting components to protect the subscriber's lines and electronic circuits to perform other service functions, such circuits being e.g. a half ringer or a maintenance termination unit. The board 15
5 has a first pair of contacts, illustrated as the tuning fork type of wiping contact, a tip contact 16 and a ring contact 17, for receiving the incoming lines from the telephone company facility. A third contact 18 is connected to the board for connection to a ground
10 contact. The contact 16 is connected by a large electrically conductive path or via 19 formed on the printed circuit board to one end of a surge protection device 20, such as a gas tube, and to a conductive path or via 21 on the back side of the board. Contact 17 is
15 connected to the opposite end of the overload protection device 20 by a via 22 and to a second via 23 on the rear side of the board. The ground contact 18 is connected by via 24 to the central terminal of the protection device 20 to carry any overload to ground that might enter the
20 board from the company lines. The board traces or vias 21 and 23 are connected to the contacts of a jack or socket 25 which is an established jack for use with a modular plug. A plug 26 is removably connected to the socket 25 and has, as illustrated has at least a pair of
25 flexible wires 27 and 28 in a sheath leading to through holes in the board 15 and to vias 29 and 32 connecting the wires to two additional, the fourth and fifth, contacts 30 and 31 adapted for connection to the wires of the subscriber's premises. The circuit board as
30 described provides protection to the customer and allows the company or the customer to disconnect the line by separating the plug 26 from the socket 25.

A half-ringer circuit is added to this board 15 by mounting a capacitor 35 between via 21 and a via 36
35 leading to one end of a diode 37, which is connected in

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series to a second diode 38, by via 39, which diode 38 is connected to a resistor 40 by via 41 to via 23.

Referring now to Figures 4, 5, and 6, The module 42 is illustrated in finished form, and disposed in a generally rectangular box having opposite faces and side walls which is formed by two shells 43 and 44, secured or bonded together to enclose the printed circuit board 15. The box has a step in the lower side wall to expose the contacts 16, 17 and 18 and the shells each have a flange 45 extending the opposite faces beyond side wall 46 through which the contacts 30 and 31 extend. The flanges 45 form means to guide the module onto the post and are each formed with an extended stud 47 to form part of a hinge for the module as will be explained.

The module 42 is adapted to fit into a terminal and be moved into place to connect a normally open circuit between the company lines and the customer wires. As illustrated in Figures 7, 8 and 9, the terminal is provided with an electrically insulative support member 50 which has a length greater than the length of the module 42. At one end of the support 50 is an eye for receiving a hold down fastener and supports for a pair of contacts 51 and 52 which are formed of plate-like conductive metal and formed at one end with insulation displacing U-shaped slots 53 to receive the ends of lines from the telephone company. The rest of the contacts 51 and 52 define a contact mating with the wiping contacts, and as illustrated they are blade contacts, which blades extend toward the opposite end of the support and are suitably held in fixed position by molded ribs on the support. At the other end of the support 50 is mounted a post 55 which extends perpendicularly to the support and supports a pair of binding posts 56 and 57 which are connected to two blade contacts 58 and 59 respectively. The blade contacts 58 and 59 are also shown in Figure 11.

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The post 55 is also provided, adjacent the top thereof, with hinge means in the form of ears 60 which receive therein the studs 47, when the module is placed at about 60° and the studs are moved into the ears.

5 Placing the module 42 as described, the module can then be pivoted to successively make connection between contact 30 and the blade 58, then between the contact 31 and the blade 59, then between the ground contact 18 and a mating contact or a mating blade type contact 62 on a
10 ground bar 63 (see figures 7, 8 and 10) to protect the customers wires and the telephone company's lines prior to connecting the final two wiping contacts 16 and 17 successively to the contacts 52 and 51, respectively. It has been found that making the connections successively
15 reduces the insertion force needed to connect the module into the circuit as the wiping contacts are opened successively.

Referring again to figure 10, and to figure 11, there is illustrated a support 50 mounted in a support
20 means or base 64 of a protected entrance terminal 65. The terminal 65 is formed with at least two access openings receiving boots 66 and 67 in the bottom wall 69. The terminal 65 is adapted to be mounted on a wall by mounting brackets 70 and 71 to place the back wall 74
25 parallel to the wall. The telephone company cable is adapted to enter the boot 66 and the customer's wires enter through boot 67. The base 64 has sufficient space to accommodate a splicing area, generally designated 75, where the incoming cable is terminated and spliced to
30 individual wires joined to the connectors 51 and 52 in the support members 50. A ground line also enters through the boot 66 and is connected to a ground bar 76, which bar 76 is connected by another wire, not shown, to the ground bar 63.

35 A single support 50 and a single module 42 is

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illustrated in the terminal base 64 in figure 10 for simplicity. Alternatively, the support member could be formed to accommodate a plurality of towers. The support could be molded to fit on the back wall 74 of the terminal 65 and accommodate a plurality of modules.

Hinged to one edge of the base 64 is a cover 78 to enclose the module or modules. To the same edge of the base, is connected a protective plate 80, which is adapted to cover the splicing area and is generally locked to the base by fasteners which pass through the plate into supports 81. On the front face of the protective plate 80 there is mounted a plurality of spacers 82, and brackets 84, only one of which is shown in Figure 10, with eyes 85 for receiving the shackle of a padlock to lock an L-shaped frame 86 in place. The frames 86 have bifurcated legs on the foot of the L-shaped frame to straddle the sheath for the wires 27 and 28 connected to the plugs 26, such that when the frame 86 is in place and locked by a padlock, access to the plug to separate the same from the socket 25 is denied. The padlocks are not illustrated in figure 11 for simplicity but this view illustrates a plurality of modules 42 in a base 64, ready to receive the incoming service lines from the company and the wires from the customers.

Having thus described the present invention with reference to a presently preferred embodiment thereof, it is to be understood that changes may be made without departing from the spirit or scope of the invention as described in the appended claims.

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Claims

1. A module for use at the interface between telephone company communications facilities incoming lines and the wiring at a subscriber's premises, said module comprising
 - a printed circuit board having
 - a first pair of contacts for receiving the incoming lines,
 - 10 a third contact for connection to ground, an outgoing pair of contacts for connection to the wiring at a subscriber's premises,
 - a surge arrestor for overvoltage protection mounted on said board and joined to said first pair of contacts,
 - 15 a socket mounted to said board and connected through said board to said first pair of contacts,
 - a plug is connected to said board by a flexible cord and at least two mounting pads, and
 - 20 circuit means connecting said mounting pads to said outgoing pair of contacts.
2. A module according to claim 1 wherein said circuit means includes a half-ringer circuit.
- 25 3. A module according to claim 1 wherein said first pair of contacts and said outgoing pair of contacts comprise tuning fork contacts for making sliding contact with blade contacts joined to the incoming lines and the wiring at the subscriber's premises for affording facile attachment and detachment of the module from the lines and wiring.
- 30 4. A module according to claim 3 wherein said circuit means comprises a ringer circuit formed of individual diodes, a resistor and a capacitor mounted on said board.
- 35

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5. The module according to claim 1 wherein said module further comprises a pair of shells which enclose said board and allow access to said socket and to said contacts for affording wiping connection of said contacts to fixed contacts of an open circuit between said lines and said wiring.

6. A protected entrance terminal comprising, support means for mounting a pair of contacts adapted for connection to two incoming lines and for supporting a ground bar,

a post positioned perpendicular to said support, said post supporting a pair of contacts having means for connection to a pair of wires, and said post having hinge means affording one portion of a pivot axis, a module comprising a generally rectangular box having opposite faces joined by side walls and enclosing a voltage protector device and having a plurality of wiping type contacts extending from two adjacent side walls of said box, and means for cooperating with said hinge means for affording pivotal movement of said box in relationship to said post to make connection between said contacts on said post and said wiping type contacts extending from one side wall and then to make contact between a ground contact extending from said adjacent side wall and said ground bar, and then between the wiping type contacts extending from said adjacent side wall and the pair of contacts supported by said support means, when said hinge means affords pivotal movement of said module.

7. A protected entrance terminal according to claim 6 wherein said module further comprises a printed circuit board having a first pair of said tuning fork contacts for receiving the incoming lines, a third tuning fork contact for connection to ground, and an outgoing pair of said tuning fork contacts for connection to the

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wiring at a subscriber's premises,

a surge arrestor for overvoltage protection mounted on said board and joined to said first pair of contacts and being connected through said board to an
5 engagable plug socket, a plug, which plug is connected to said board by a flexible cord and at least two mounting pads, and

circuit means connecting said mounting pads to said outgoing pair of contacts.

10

8. A protected entrance terminal according to claim 7 wherein a plurality of modules are connected to said support means and to said ground bar and a plurality of posts connect said modules to subscriber's premises
15 wiring.

9. A protected entrance terminal for receiving the incoming lines from a telephone company's facility and connecting the same to the wiring from a subscriber's premises, said terminal comprising a housing unit having
20 a base and a cover, said base having inlet openings for insertion of cables and wires into said base,
means in said base for defining a splicing area,

support means positioned in said base for
25 mounting at least a pair of blade contacts adapted for connection to two incoming lines from a said cable and for supporting a ground bar,

post means positioned upright in said base for supporting at least a pair of blade contacts having
30 electrical contact means connected thereto for connection to a pair of wires, and said post means having hinge means affording one portion of a pivot axis,

at least one module comprising a generally rectangular box having opposite faces joined by side
35 walls and enclosing a surge arrestor for overvoltage

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protection and having a plurality of wiping contacts extending from two adjacent side walls of said box, and means cooperating with said hinge means for affording pivotal movement of said box in relationship to said post
5 means to make connection between said pair of blade contacts on said post and said wiping contacts extending from one side wall and then to make contact between a wiping contact and said ground bar extending from an adjacent side wall, and then to make successive
10 connection between the wiping contacts on said adjacent side wall and the pair of blade contacts supported on the support means upon pivotal movement of said module.

10. A protected entrance terminal according to claim 9 wherein said module comprises
15 a printed circuit board having
a first pair of said contacts for receiving the incoming lines,
a third contact for connection to said ground bar,
20 an outgoing pair of contacts for connection to the wiring at a subscriber's premises,
said surge arrestor mounted on said board and joined to said first pair of contacts,
a socket mounted to said board and
25 connected through said board to said first pair of contacts,
a plug is connected to said board by a flexible cord and at least two mounting pads, and
circuit means connecting said mounting
30 pads to said outgoing pair of contacts.

AMENDED CLAIMS

[received by the International Bureau on 29 January 1992 (29.01.92);
original claim 2 cancelled; claim 1 amended;
claims 3,5,6 and 9 renumbered as claims 2,4,7 and 10;
claims 4,7,8 and 10 amended and renumbered as claims 3,8,9 and 11;
new claims 5 and 6 added (6 pages)]

1. A replaceable line module for use at the
5 interface between telephone company communications
facilities incoming lines and the wiring at a subscriber's
premises, said module comprising
a printed circuit board having
a first pair of contacts for receiving the
10 incoming lines from a company facility,
a third contact for connection to ground,
an outgoing pair of contacts for connection
to the wiring at a subscriber's premises,
surge arrestor means for overvoltage
15 protection mounted on said board and joined to said first
pair of contacts and to said third contact to protect other
electronic circuits on said board,
a socket mounted to said board and connected
through said board to said first pair of contacts,
20 a plug adapted for connection to said socket
and connected to said board by a flexible cord and
connected by at least two vias on the board to said
outgoing pair of contacts, and
a half-ringer circuit connected to said
25 first pair of contacts between said arrestor means and said
socket.
2. A module according to claim 1 wherein said
first pair of contacts and said outgoing pair of contacts
comprise tuning fork contacts for making sliding contact
30 with blade contacts joined to the incoming lines and the
wiring at the subscriber's premises for affording facile
attachment and detachment of the module from the lines and
wiring.
3. A module according to claim 1 wherein said
35 half-ringer circuit comprises individual diodes, a resistor
and a capacitor mounted on said board.

4. The module according to claim 1 wherein said module further comprises a pair of shells which enclose said board and allow access to said socket and to said contacts for affording wiping connection of said contacts to fixed contacts of an open circuit between said lines and said wiring.

5. A replaceable line module for use at the interface between telephone company communications facilities incoming lines and the wiring at a subscriber's premises, said module comprising a generally rectangular printed circuit board having two end edges and two side edges,

a first pair of contacts for receiving the incoming lines from the company facility positioned along and extending from one side edge,

a third contact for connection to ground positioned along said one side edge and between said first pair of contacts and one adjacent end edge,

an outgoing pair of contacts for connection to the wiring at a subscriber's premises positioned to extend from said adjacent end edge,

surge arrestor means for overvoltage protection mounted on said board and joined to said first pair of contacts, said arrestor means being connected between the first pair of contacts and the ground contact for protecting electronic circuits for rendering service functions,

a socket mounted to said board along the other side edge and connected through vias on said board to said first pair of contacts, and

a plug connected to said board by a flexible cord and at least two vias to said outgoing pair of contacts, such that when said plug and said socket are connected, said first contacts are joined to said outgoing contacts, with said surge arrestor therebetween,

whereby said outgoing pair of contacts may be connected with external contacts and the circuit board pivoted to connect the third contact to a ground contact
5 the first pair of contacts connect to external contacts leading to the company facility.

6. A module according to claim 5 wherein electronic circuit means are mounted on said board between said arrestor means and said socket, said circuit means
10 including a half-ringer circuit.

7. A protected entrance terminal comprising, support means for mounting a pair of contacts adapted for connection to two incoming lines and for supporting a ground bar,

15 a post positioned perpendicular to said support, said post supporting a pair of contacts having means for connection to a pair of wires, and said post having hinge means affording one portion of a pivot axis,

a module comprising a generally rectangular box
20 having opposite faces joined by side walls and enclosing a voltage protector device and having a plurality of wiping type contacts extending from two adjacent side walls of said box, and means for cooperating with said hinge means for affording pivotal movement of said box in relationship
25 to said post to make connection between said contacts on said post and said wiping type contacts extending from one side wall and then to make contact between a ground contact extending from said adjacent side wall and said ground bar, and then between the wiping type contacts extending from
30 said adjacent side wall and the pair of contacts supported by said support means, when said hinge means affords pivotal movement of said module.

7. A protected entrance terminal according to claim 6 wherein said module further comprises a printed
35 circuit board supporting the pair of said tuning fork contacts for receiving the incoming lines, the tuning fork

contact for connection to said ground contact, and an outgoing pair of the tuning fork contacts for connection to the wiring at a subscriber's premises,

5 surge arrestor means for overvoltage protection mounted on said board and joined to said pair of contacts for receiving the incoming lines and for protecting other electronic circuits on said board and being connected to an engagable plug socket, a plug, which plug is connected to
10 said board by a flexible cord and at least two vias connected to said outgoing pair of tuning fork contacts, and

 circuit means connected to said first pair of contacts for performing service functions.

15 8. A protected entrance terminal according to claim 7 wherein a plurality of modules are connected to said support means and to said ground bar and a plurality of posts connect said modules to subscriber's premises wiring.

20 9. A protected entrance terminal for receiving the incoming lines from a telephone company's facility and connecting the same to the wiring from a subscriber's premises, said terminal comprising a housing unit having a base and a cover, said base having inlet openings for
25 insertion of cables and wires into said base,

 means in said base for defining a splicing area, support means positioned in said base for mounting at least a pair of blade contacts adapted for connection to two incoming lines from a said cable and for
30 supporting a ground bar,

 post means positioned upright in said base for supporting at least a pair of blade contacts having electrical contact means connected thereto for connection to a pair of wires, and said post means having hinge means
35 affording one portion of a pivot axis,

at least one module comprising a generally rectangular box having opposite faces joined by side walls and enclosing a surge arrestor for overvoltage protection and having a plurality of wiping contacts extending from two adjacent side walls of said box, and means cooperating with said hinge means for affording pivotal movement of said box in relationship to said post means to make connection between said pair of blade contacts on said post and said wiping contacts extending from one side wall and then to make contact between a wiping contact and said ground bar extending from an adjacent side wall, and then to make successive connection between the wiping contacts on said adjacent side wall and the pair of blade contacts supported on the support means upon pivotal movement of said module.

10. A protected entrance terminal according to claim 9 wherein said module comprises

a printed circuit board having mounted thereon
a first pair of said contacts for receiving the incoming lines,

a third contact for connection to said ground bar,

an outgoing pair of contacts for connection to the wiring at a subscriber's premises,

said surge arrestor joined to said first pair of contacts to protect other electronic circuits on said board,

a socket mounted to said board and connected to said first pair of contacts,

a plug is connected to said board by a flexible cord and at least two vias connecting said flexible cord to said outgoing pair of contacts.

11. A protected entrance terminal according to claim 10 wherein additional electronic circuit means are mounted on said board and connected between said surge
5 arrestor and said socket.

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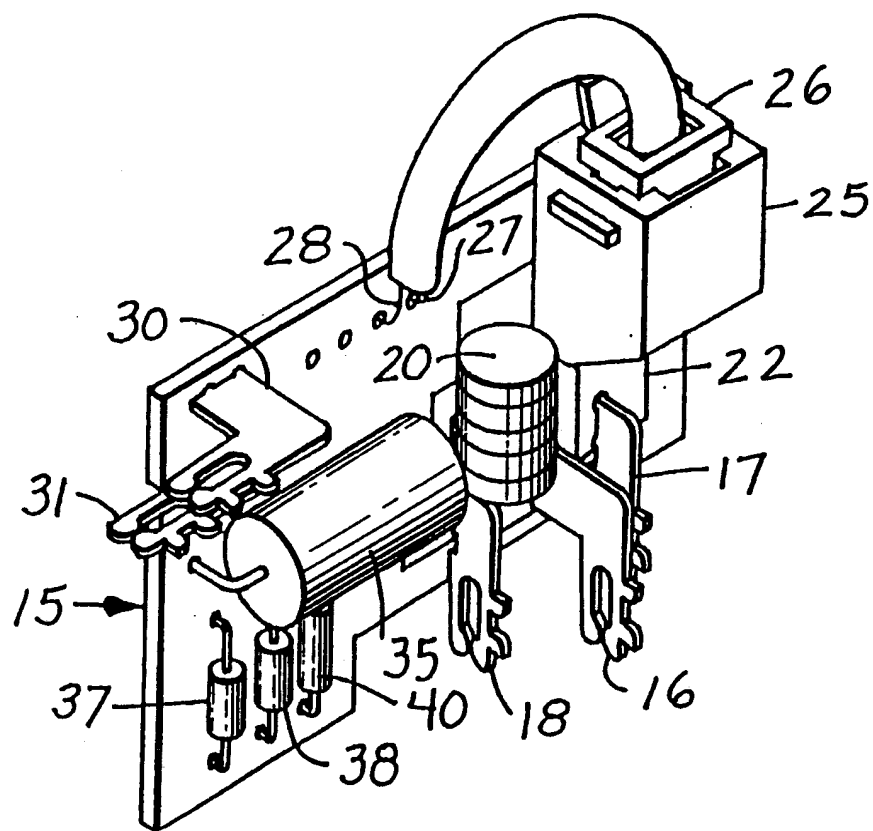


FIG. 1

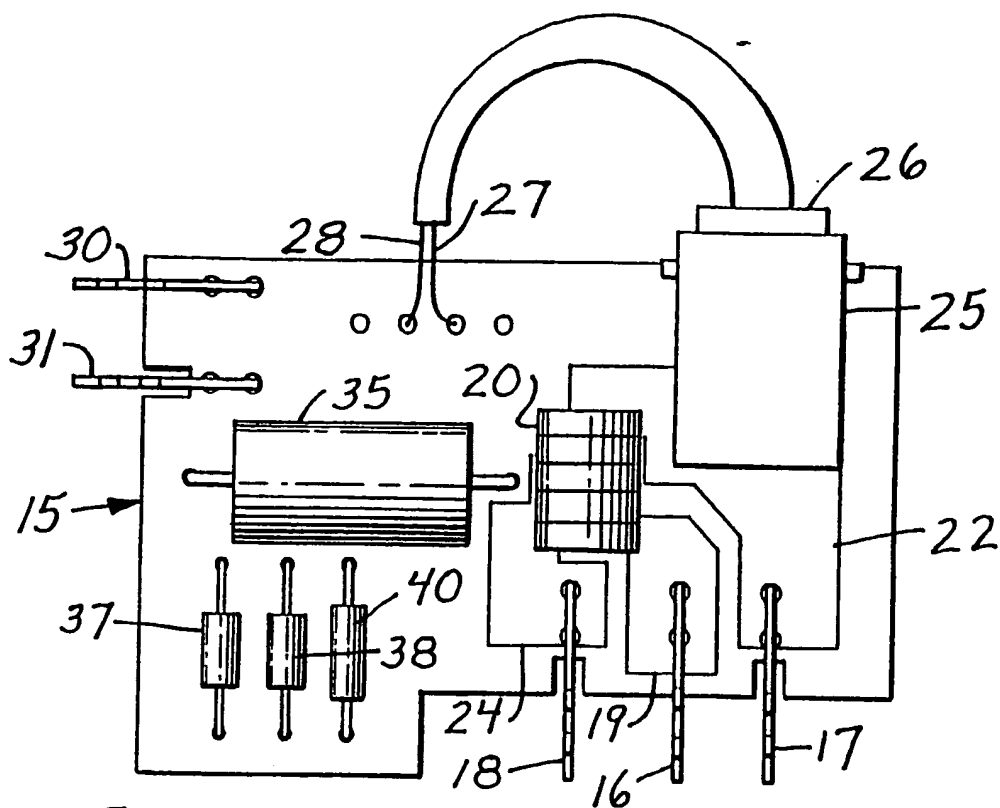


FIG. 2

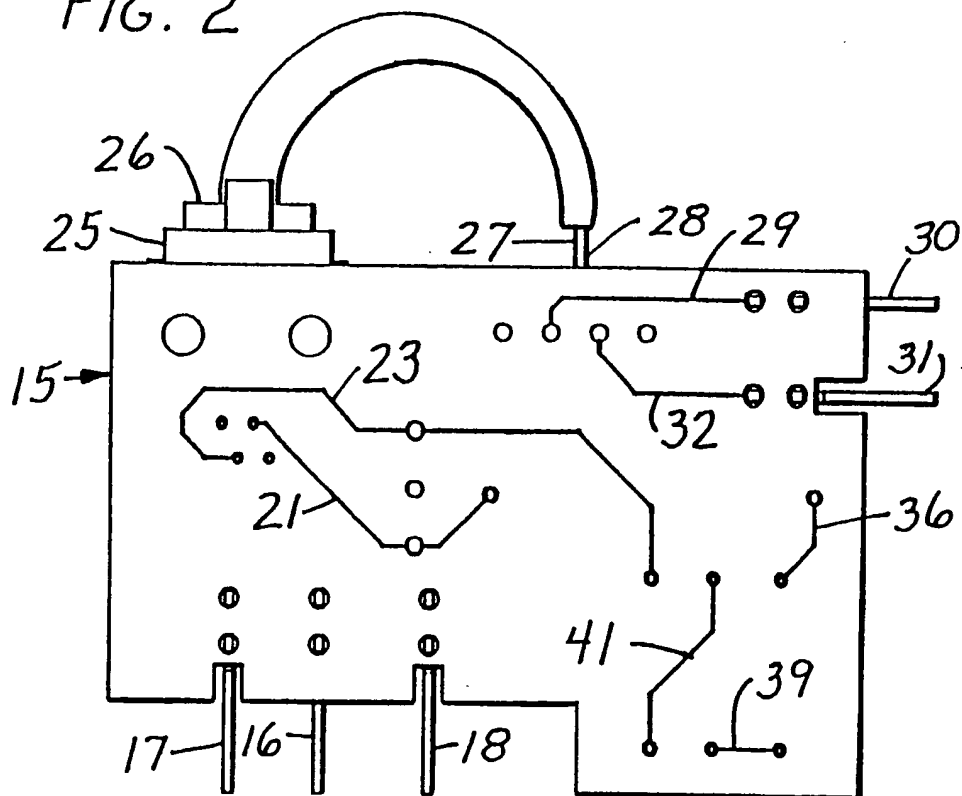


FIG. 3

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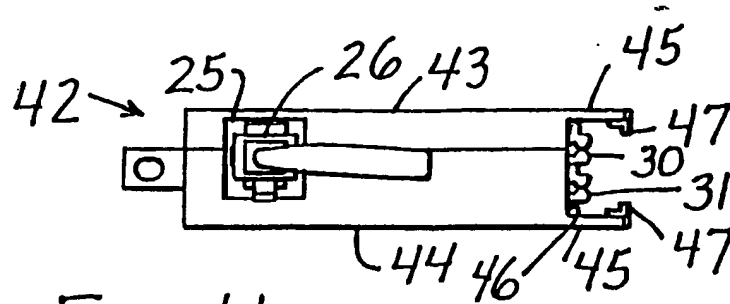


FIG. 4

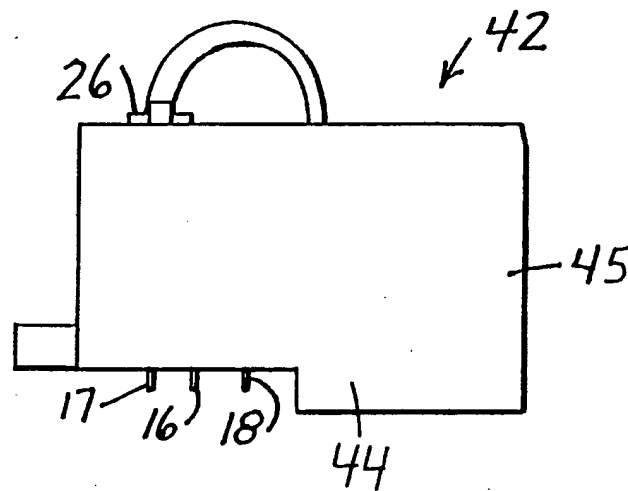


FIG. 5

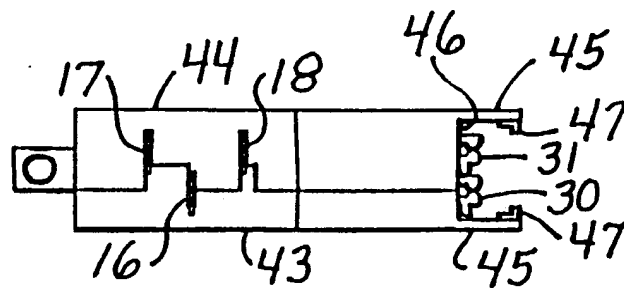


FIG. 6

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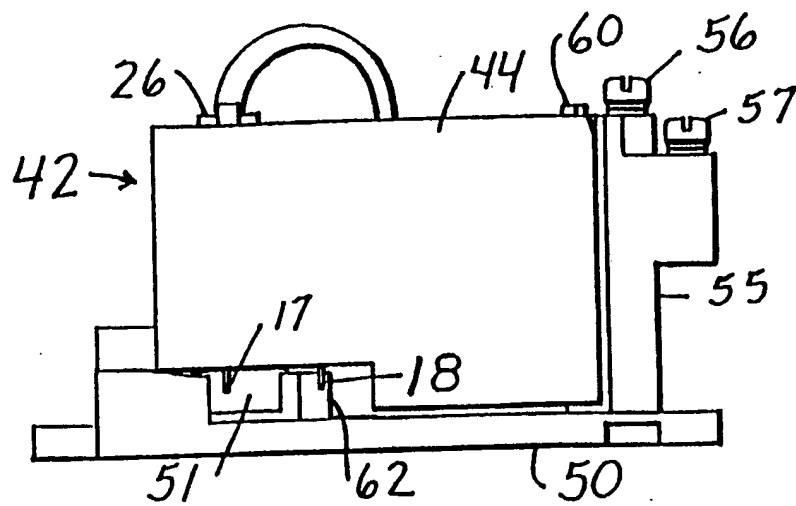


FIG. 7

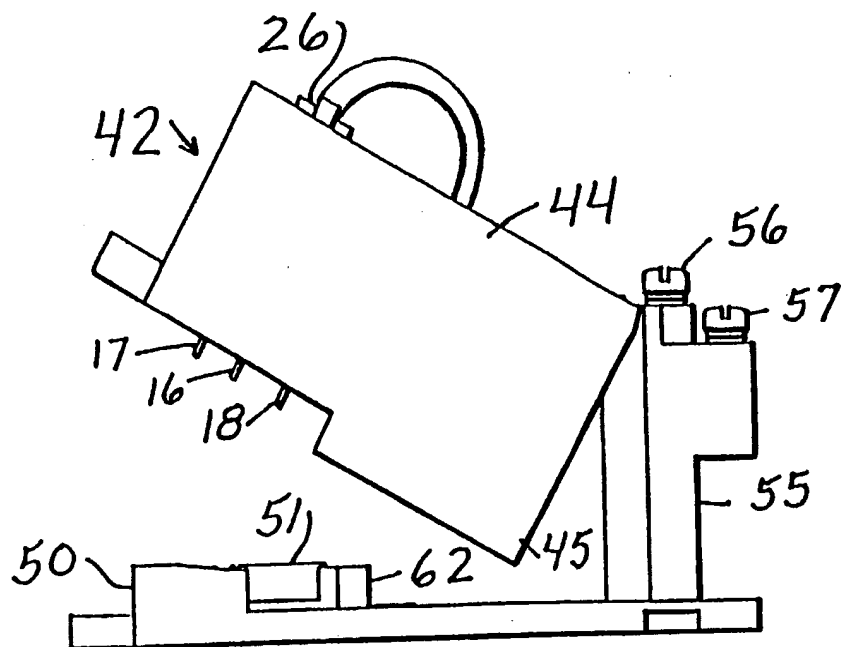
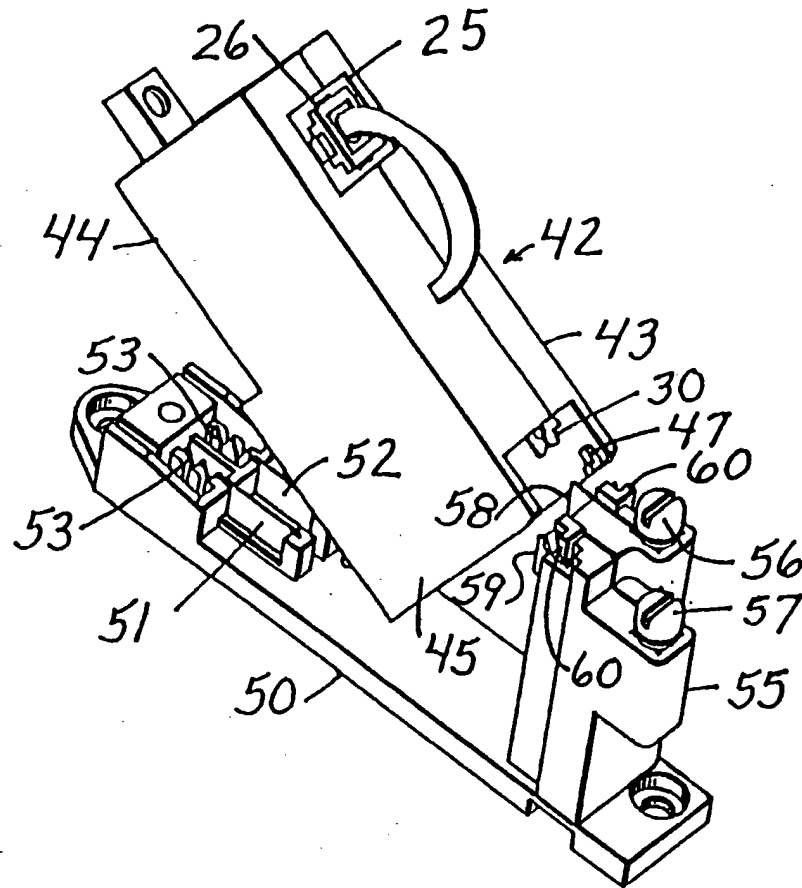


FIG. 8



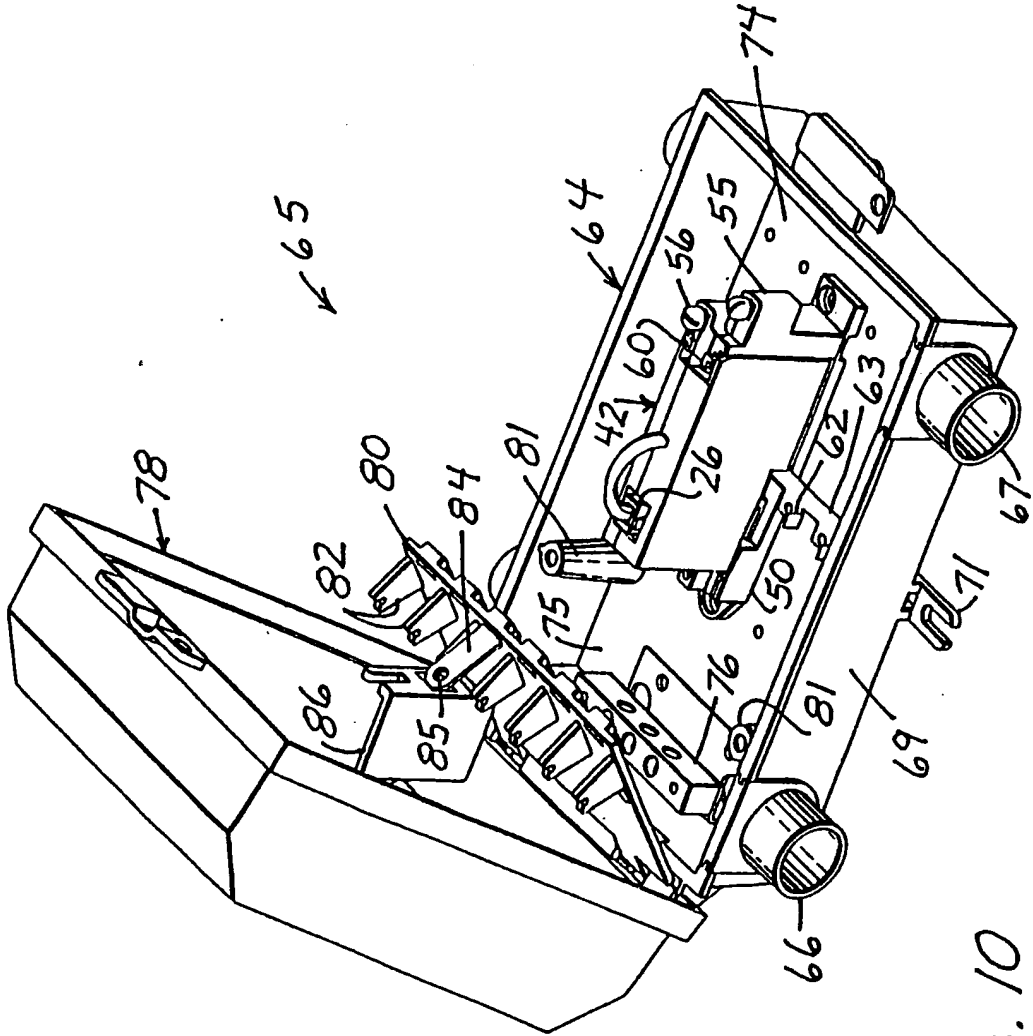


FIG. 10

- 717 -

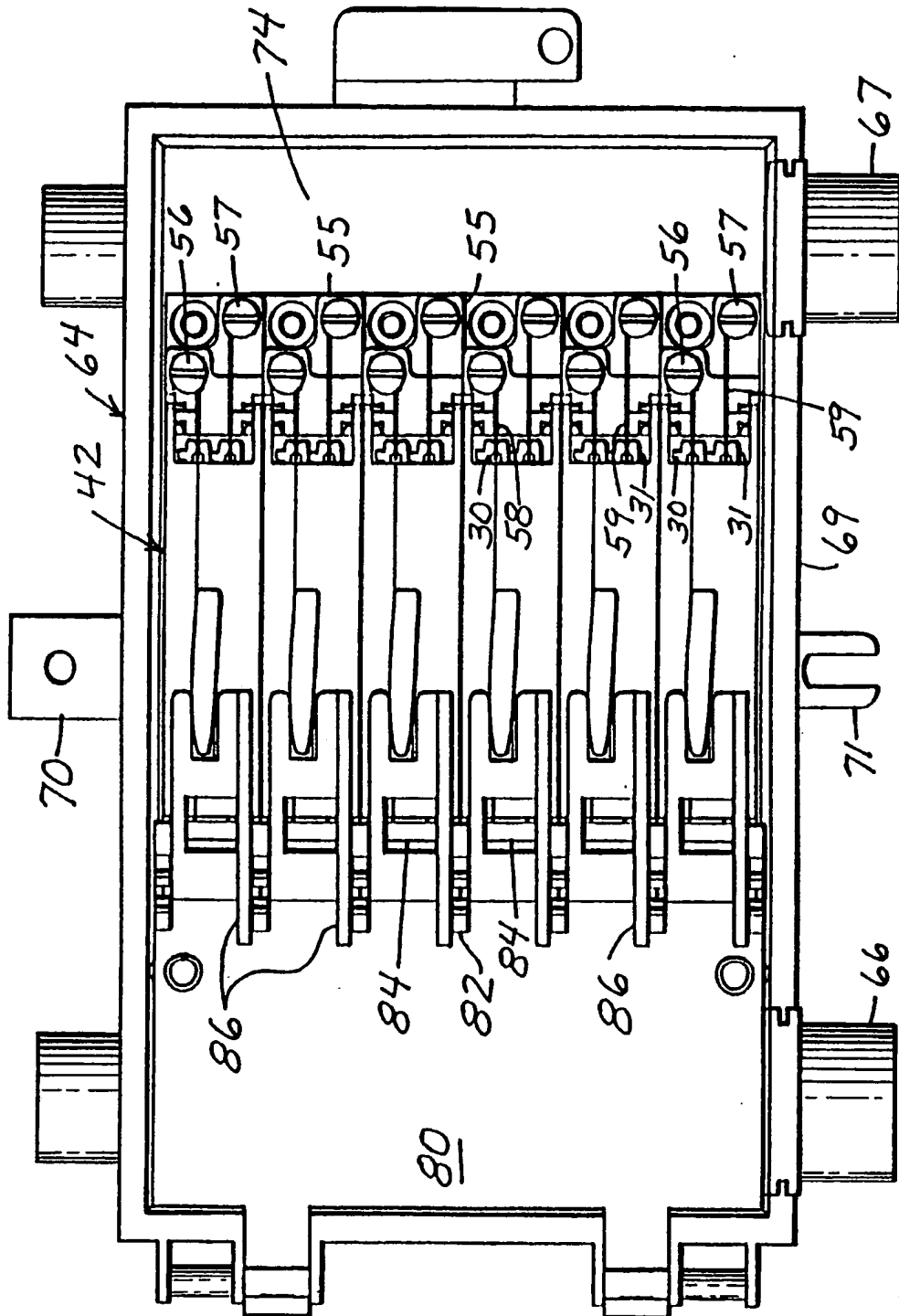


FIG. 11

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 91/05058

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: H 04 M 1/74, H 01 T 4/06, H 01 R 13/66, H 05 K 7/16																				
II. FIELDS SEARCHED <div style="text-align: center; margin-top: 10px;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none; vertical-align: top;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%; padding: 5px;">Classification System</th> <th style="padding: 5px;">Classification Symbols</th> </tr> <tr> <td style="padding: 5px; vertical-align: top;">IPC5</td> <td style="padding: 5px; vertical-align: top;">H 01 R; H 01 T; H 02 B; H 02 H; H 04 M; H 04 Q; H 05 K</td> </tr> </table> </td> <td style="border: none;"></td> </tr> </table> <div style="text-align: center; margin-top: 10px;">Documentation Searched other than Minimum Documentation to the extent that such Documents are included in Fields Searched⁸</div>			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%; padding: 5px;">Classification System</th> <th style="padding: 5px;">Classification Symbols</th> </tr> <tr> <td style="padding: 5px; vertical-align: top;">IPC5</td> <td style="padding: 5px; vertical-align: top;">H 01 R; H 01 T; H 02 B; H 02 H; H 04 M; H 04 Q; H 05 K</td> </tr> </table>	Classification System	Classification Symbols	IPC5	H 01 R; H 01 T; H 02 B; H 02 H; H 04 M; H 04 Q; H 05 K													
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III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; padding: 5px;">Category *</th> <th style="width: 60%; padding: 5px;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 30%; padding: 5px;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top; text-align: center;">Y</td> <td style="vertical-align: top;">US, A, 4317154 (T.M. PASSARELLA) 23 February 1982, see abstract; figures 2-3</td> <td style="vertical-align: top; text-align: center;">1-5</td> </tr> <tr> <td style="vertical-align: top; text-align: center;">A</td> <td style="vertical-align: top; text-align: center;">--</td> <td style="vertical-align: top; text-align: center;">6-10</td> </tr> <tr> <td style="vertical-align: top; text-align: center;">Y</td> <td style="vertical-align: top;">US, A, 4390921 (B.W. BAUMBACH) 28 June 1983, see abstract</td> <td style="vertical-align: top; text-align: center;">1-5</td> </tr> <tr> <td style="vertical-align: top; text-align: center;">Y</td> <td style="vertical-align: top;">US, A, 4488008 (T.A. DELLINGER ET AL) 11 December 1984, see column 4, line 5 - line 42</td> <td style="vertical-align: top; text-align: center;">2,4</td> </tr> <tr> <td style="vertical-align: top; text-align: center;"></td> <td style="vertical-align: top; text-align: center;">--</td> <td style="vertical-align: top;"></td> </tr> </tbody> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	Y	US, A, 4317154 (T.M. PASSARELLA) 23 February 1982, see abstract; figures 2-3	1-5	A	--	6-10	Y	US, A, 4390921 (B.W. BAUMBACH) 28 June 1983, see abstract	1-5	Y	US, A, 4488008 (T.A. DELLINGER ET AL) 11 December 1984, see column 4, line 5 - line 42	2,4		--	
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<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>* Special categories of cited documents:¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 48%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>																				
IV. CERTIFICATION <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Date of the Actual Completion of the International Search</td> </tr> <tr> <td style="padding: 5px;">18th November 1991</td> </tr> </table> </td> <td style="width: 50%; border: none; vertical-align: top;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="padding: 5px; text-align: center;">29. 11. 91</td> </tr> </table> </td> </tr> <tr> <td style="border: none; vertical-align: top;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">International Searching Authority</td> </tr> <tr> <td style="padding: 5px; text-align: center;">EUROPEAN PATENT OFFICE</td> </tr> </table> </td> <td style="border: none; vertical-align: top;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Signature of Authorized Officer</td> </tr> <tr> <td style="padding: 5px;"> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 10px;">M. PEIS</div> <div style="font-family: cursive; font-size: 1.2em;">M. Peis</div> </div> </td> </tr> </table> </td> </tr> </table>			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Date of the Actual Completion of the International Search</td> </tr> <tr> <td style="padding: 5px;">18th November 1991</td> </tr> </table>	Date of the Actual Completion of the International Search	18th November 1991	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="padding: 5px; text-align: center;">29. 11. 91</td> </tr> </table>	Date of Mailing of this International Search Report	29. 11. 91	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">International Searching Authority</td> </tr> <tr> <td style="padding: 5px; text-align: center;">EUROPEAN PATENT OFFICE</td> </tr> </table>	International Searching Authority	EUROPEAN PATENT OFFICE	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Signature of Authorized Officer</td> </tr> <tr> <td style="padding: 5px;"> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 10px;">M. PEIS</div> <div style="font-family: cursive; font-size: 1.2em;">M. Peis</div> </div> </td> </tr> </table>	Signature of Authorized Officer	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 10px;">M. PEIS</div> <div style="font-family: cursive; font-size: 1.2em;">M. Peis</div> </div>						
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
Y	US, A, 4616288 (H. SCHOLTHOLT ET AL) 7 October 1986, see abstract; figures 2,6 --	3
Y	US, A, 4624514 (T.J. SMITH) 25 November 1986, see abstract; figures 1-6 --	1-5
Y	US, A, 4922374 (S. MUELLER ET AL) 1 May 1990, see column 3, line 12 - line 24; figure 1 --	5
Y	DE, C2, 3148740 (FRITZ KUKE KG) 11 April 1985, see figure 1 --	2,4
A	US, A, 3093773 (T.M. COLE) 11 June 1963, see figure 2 -- -----	1-10

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. PCT/US 91/05058**

SA 50673

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The members are as contained in the European Patent Office EDP file on 27/09/91
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4317154	23/02/82	NONE	
US-A- 4390921	28/06/83	CA-A- 1180373 EP-A- 0077136 JP-A- 58073297	01/01/85 20/04/83 02/05/83
US-A- 4488008	11/12/84	NONE	
US-A- 4616288	07/10/86	AU-D- 2617284 DE-A-C- 3311488 EP-A- 0123905 JP-A- 59194373 SU-A- 1308207	04/10/84 11/10/84 07/11/84 05/11/84 30/04/87
US-A- 4624514	25/11/86	NONE	
US-A- 4922374	01/05/90	NONE	
DE-C2- 3148740	11/04/85	DE-A- 3304003 EP-A- 0082800	16/08/84 29/06/83
US-A- 3093773	11/06/63	NONE	

For more details about this annex : see Official Journal of the European patent Office, No. 12/82